

Revised: Spring 2023

# **MDL 262**

## **Clinical Chemistry II**

### **COURSE OUTLINE**

#### **Prerequisites:**

MDL 261 or equivalent

#### **Course Description:**

Introduces the basic principles of clinical chemistry, including a description of automation in the laboratory, and clinical chemistry techniques and point of care testing. Focuses on Blood gases, pH and buffer systems, and porphyrins/hemoglobin. Also concentrates on the assessment of organ system functions, including the endocrine system, calcium homeostasis, hepatic functions, cardiovascular system functions, renal function tests, and pancreatic functions. Discusses therapeutic drug monitoring techniques, clinical toxicology, and nutrition assessment.

**Semester Credits: 4**

**Lecture Hours: 3**

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# MDL 262 Clinical Chemistry II

## Student Outcomes for the Course:

At the completion of this course, the student should be able to:

- Measure and interpret blood gas testing results
- Describe the structure and functions of the various organ systems of the human body along with disease states that can affect each system discussed
- Describe the components of the endocrine system, the structure and function of hormones, and the pathology of endocrine diseases
- Identify normal ranges of hormones in the bloodstream; know the conditions associated with hypo- or hyper secretion of the hormones discussed
- Identify the analytes that can be used as markers of disease states, such as cardiac and liver enzymes
- Identify the drugs commonly assayed in therapeutic drug monitoring (TDM) and their clinical usage, and how to measure drug metabolites in the clinical laboratory
- Identify toxic substances that are commonly identified in the clinical setting such as illicit drugs and heavy metals, and understand how they are harmful to exposed humans
- Correlate the various tumor markers with the cancers they are associated with; perform assays for tumor markers in the laboratory
- Describe various disease states caused by nutritional factors, including diabetes, and assay for specific nutrients critical for normal homeostasis
- Recognize how pre-analytical, post-analytical and especially analytical errors can affect test results

## Textbook:

Clinical Laboratory Chemistry 2<sup>nd</sup> Edition by R. L. Sunheimer and L. Graves  
Pearson ISBN: 978-0134413327

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# Course Outline

## **I. Circulating Tumor Markers**

- A. Tumor Markers
- B. Clinical Applications
- C. Clinical Measurement
- D. Methodologies
- E. Selected Tumor Markers
- F. Germ Cell Tumors
- G. Prostate Disease
- H. Ovarian Cancer
- I. Colorectal Cancer
- J. Pancreatic Cancer
- K. Bladder Cancer
- L. Lung Cancer
- M. Gastric/Gallbladder Cancer

## **II. Blood Gases and pH**

- A. Buffers and Acid-Base Balance
- B. Respiratory System and Gas Exchange
- C. Distribution of Gases in the Body
- D. Role of Kidneys in Acid-Base Balance
- E. Disorders of Acid-Base Balance
- F. Measurement of Blood Gases
- G. Hemoglobin Measurement
- H. Derived Parameters

## **III. Mineral and Bone Metabolism**

- A. Minerals, Parathyroid Hormone, Calcitonin, and Vitamin D
- B. Bone Structure, Physiology and Metabolism
- C. Biomarkers of Bone Formation and Resorption
- D. Metabolic Bone Disorders

## **IV. Introduction to Hormones-Hypothalamic and Pituitary**

- A. Introduction
- B. Techniques of Hormone Measurement

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- C. Interpretation of Hormone Results
- D. Endocrine Function Assessment
- E. Pituitary Gland and Hypothalamus

## **V. Thyroid Function**

- A. Thyroid Gland Function
- B. Thyroid Hormones
- C. Thyroid Function Testing
- D. Thyroid Diseases

## **VI. Adrenal Function**

- A. Adrenal Medullary Hormones
- B. Adrenal Cortical Hormones
- C. Clinicopathologic Correlations
- D. Adrenal Hyperfunction

## **VII. Pancreatic Function**

- A. Pancreatic Anatomy and Physiology
- B. Assessment of Exocrine Pancreatic Function
- C. Assessment of Endocrine Pancreatic Function
- D. Tumor Markers
- E. Pancreatic Diseases (Neoplasms, Insulinomas, Glucagonomas, Somatostatinomas)

## **VIII. Cardiac Function**

- A. Review of Heart Anatomy and Physiology
- B. Cardiac Disease
- C. Cardiac Biomarkers
- D. POCT for Cardiac Biomarkers

## **IX. Liver Functions**

- A. Liver Anatomy and Physiology
- B. Bilirubin Metabolism
- C. Pathological Hepatic Conditions
- D. Liver Function Tests



## **X. Iron, Porphyrins, and Hemoglobin**

- A. Iron
- B. Ferritin and Transferrin
- C. Porphyrins
- D. Erythropoietic Porphyrins
- E. Hemoglobin

## **XI. Therapeutic Drug Monitoring**

- A. Pharmacokinetics
- B. Clinical Pharmacokinetics
- C. Pharmacodynamics
- D. Preanalytical Conditions
- E. Specific Drug Groups
- F. Antibiotics
- G. Antiepileptic Drugs
- H. Antineoplastic Drugs
- I. Psychotherapeutic Drugs
- J. Anti-asthmatic Drugs
- K. Cardiac Drugs
- F. Immunosuppressive Drugs
- G. Analytical Techniques

## **XII. Vitamins**

- A. Assessment of Vitamin Status
- B. Fat Soluble Vitamins
- C. Water soluble vitamins
- D. Vitamin B12
- E. Folic Acid

## **XIII. Molecular Diagnostics**

- A. Gene Structure and Expression
- B. Introduction to Molecular Diagnostics
- C. Nucleic Acid Isolation
- D. Gel Electrophoresis
- E. Restriction Enzymes
- F. Hybridization Assays/Blotting Techniques
- G. DNA Microarrays
- H. DNA Amplification and Sequencing

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## **Laboratory Topics**

Lab # 1: Alkaline Phosphatase

Lab # 2: Acid phosphatases-Total + Prostatic

Lab # 3: Iron and Iron Binding Capacity

Lab # 4: Calcium Measurement

Lab # 5: Bilirubin; Total and Direct

Lab # 6: Creatine kinase (CPK)

Lab # 7: Creatinine and Creatinine Clearance

Lab # 8: Amylase

Lab # 9: Acetaminophen and Salicylate

Lab # 10: Ethanol Measurement

Lab # 11: AST (SGOT)

Lab # 12: Hemoglobin A1C

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